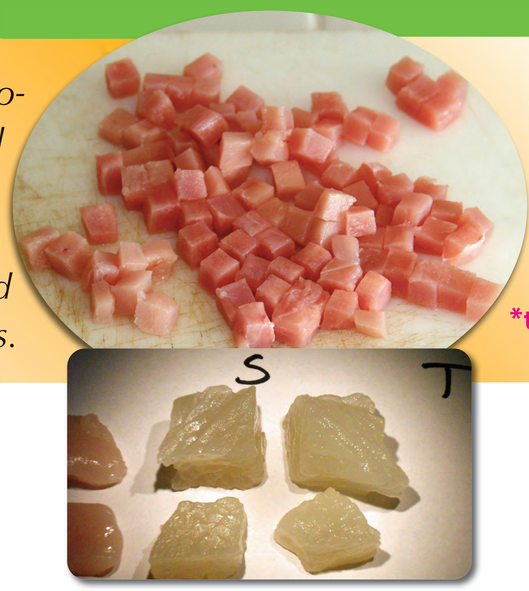
Prediction of pH Changes During Immersion of Meat Proteic Matrices in Acidic Marinades

ACIDIC marination is a widespread method of improving the techno-functional properties of meat. By acting on the pH, it controls several components relating to the meat's quality, such as water holding capacity, tenderness, juiciness and colour. To be able to predict the pH reached in meat cubes after marination, we have proposed a method based on the preliminary determination on the buffering capacity of meat homogenates.



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Results and discussion

The method was based on the determination of the equilibrium between free and bound protons (name Hb hereafter) brought by a strong acid (hydrochloric) in a meat homogenate (turkey breast). Then a standard acid marination process was implemented by soaking meat cubes in water-acetic acid-NaCl solutions for time up to 360 minutes. Pictures 1 & 2 show the meat cubes before and after marination process.

Although various lean fish and meat show similar protein contents, they can behave differently upon acidification. In the pH domain of acid marination, this can be linked to the lactate content. Fig 1 shows buffering capacity and bound protons on turkey breast meat and dab fillet as a function of pH. These meats contain respectively around 92 and 17 mmol kg^{-1} of L-lactate. Fig 2 shows that it is possible to calculate the pH of meat homogenates acidified by a weak acid if the buffering capacity of meat is taken into account. However, in the case of meat cubes marination, the calculed pH was by far over-estimated by calculus. The buffering capacity of the meat after marination averages 20% of the initial one, and might be explained by the high loss of proteins and lactate (Table I).

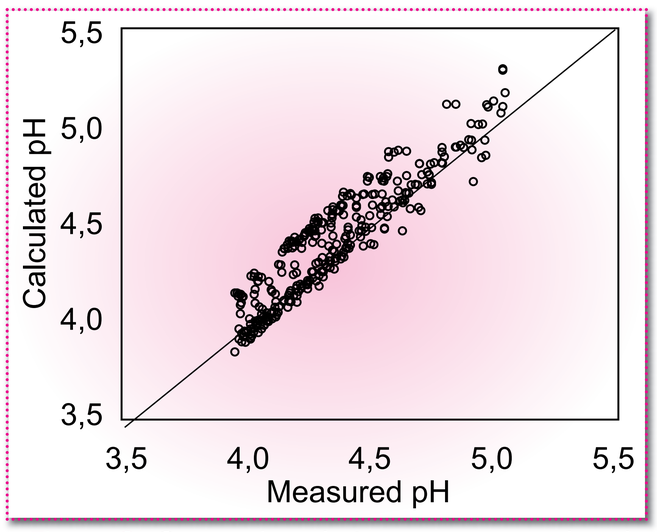

Figure 2. Comparison between measured and calculated pH for various meat and fish muscle homogenates (turkey breast, chicken thigh, breast and drumstick, dab fillet and beef sirloin) acidified by acetic acid (0.5N).

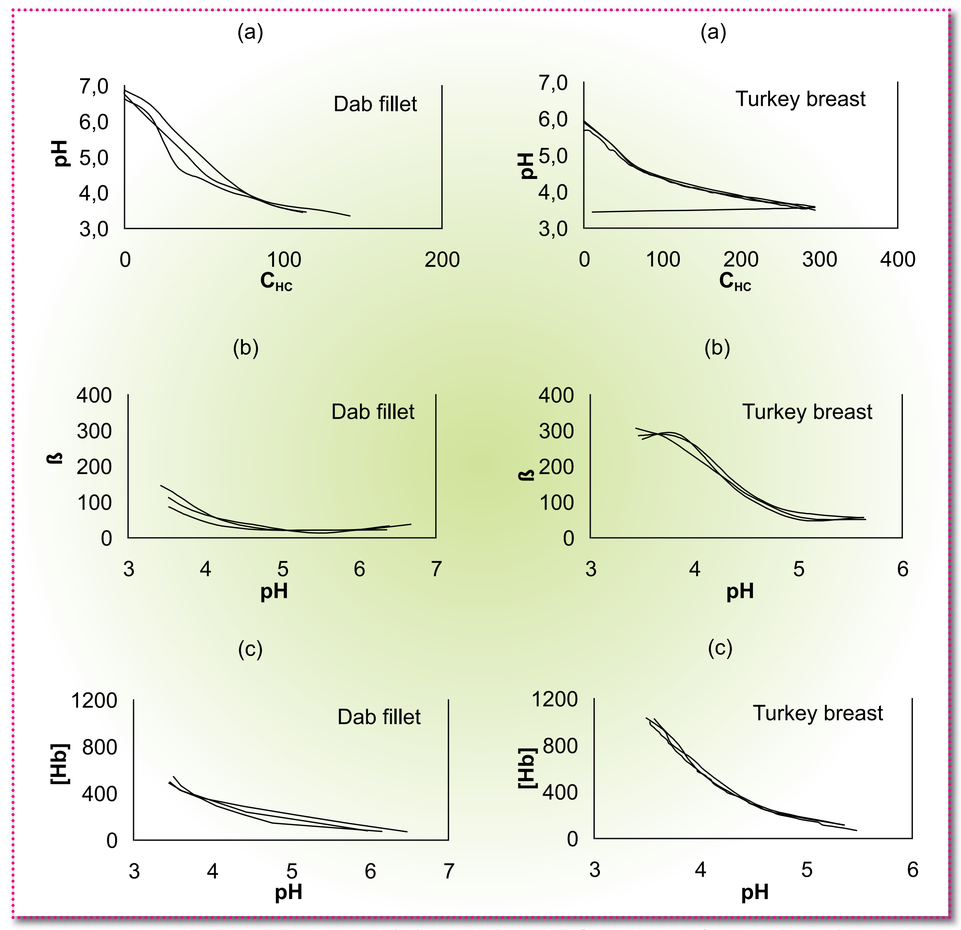

Figure 1. Hydrochloric acid (0.1 M) acidification of a turkey breast homogenate and a dab fillet homogenate: (a) evolution of buffering capacity ß () as a function of pH; (b) evolution ofbound proton concentration [Hb] () as a function of pH.

Table I. Dry matter loss and fall in L-lactate content as a function of immersion time of the turkey meat cubes in marinades.

Time (h)	Dry matter loss (%)1	Fall in lactate content (%)2
0.5	16.1 ± 6.1	33
3	20.0 ± 6.4	66
6	23.2 ± 6.4	70

1 % of initial dry matter (w/w).
2 % of initial lactates (w/w).

Conclusion

THE pH prediction of meat cubes after marination by a weak acid was not satisfactory when based on the buffering capacity of a meat homogenate. The follow up of high buffering capacity molecules –as lactates- loss after 6 hours marination explained most of the overestimation of the pH obtained by calculation. With a view to technological implementation of the marination process, one should also take into consideration the accumulation of buffering compounds for its impact on the regularity of quality of successive batches if the marinade is reused.

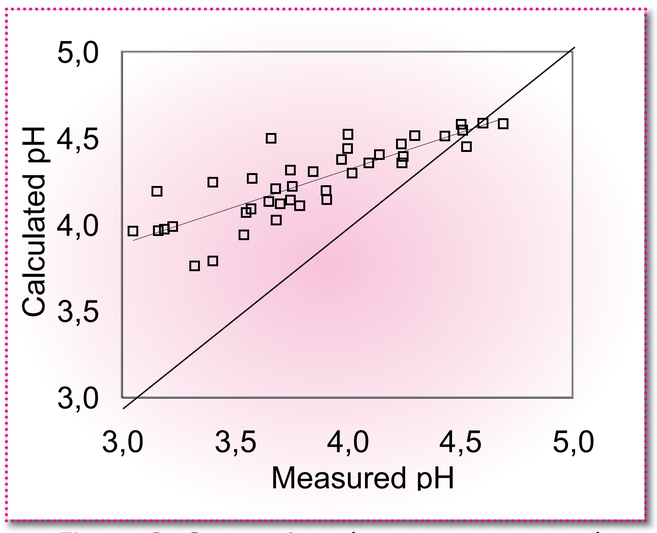

Figure 3. Comparison between measured and calculated pH for meat cubes (turkey breast) marinated in solutions of acetic acid (0.25 and 1.03M) and salt (0 to 1.5M) for durations from 0.25 to 6 h.

These data have been extracted from the article

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